Winning the Clean Energy Innovation Race

ARPA-E Energy Innovation Summit

National Harbor, MD

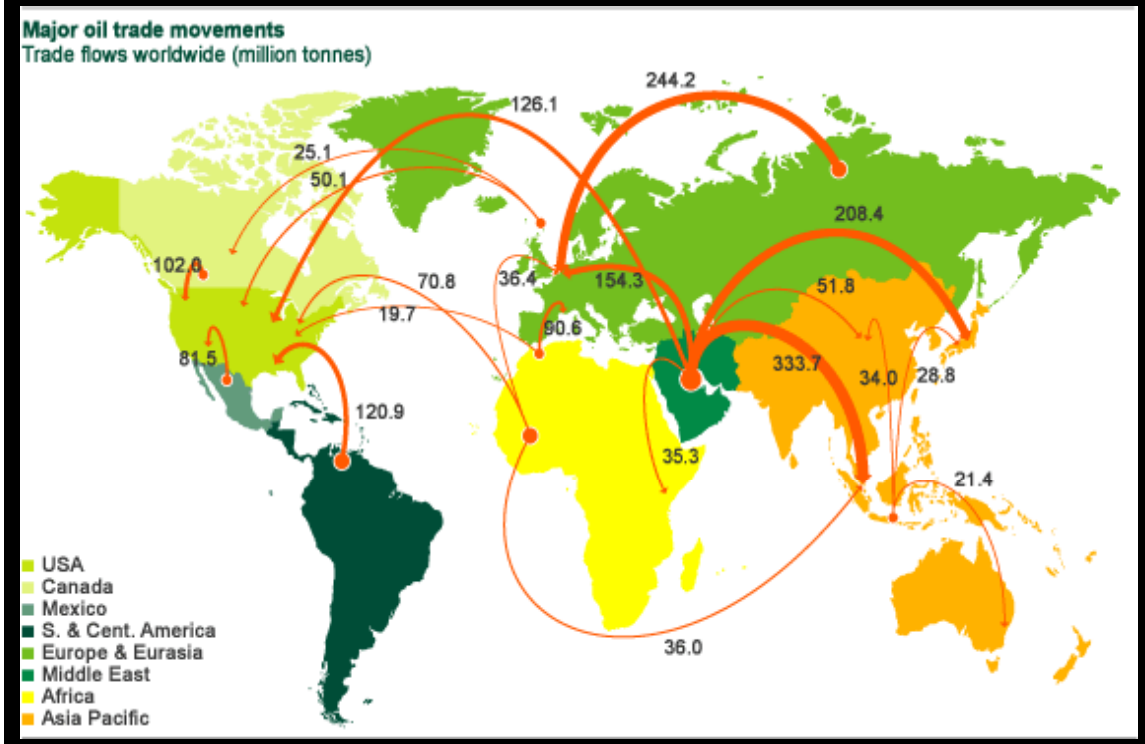
1 March, 2011

Price of oil *will* go up in the coming decades

Oil prices: 1996 - 2011

- Here?
- Here?
- Here?

In 2015 or 2020, what will be the price of oil?



Oil trade

$400 B flows ***out*** of the U.S. to ***import*** energy.

There will also be tremendous increase in the demand for accessible and affordable clean energy.

Our National Security is dependent on our Energy Security

Energy created at home is wealth creation at home.

Wayne Gretzky: “I skate to where the puck is going to be, not where it’s been.”

… and so should America.

We must decrease our dependency on oil

Increasing fuel efficiency

Electrification of vehicles

Bio-fuels

jbei
Joint BioEnergy Institute

BESC
BioEnergy Science Center

GREAT LAKES BIOENERGY
RESEARCH CENTER

AMYRIS
BIOTECHNOLOGIES

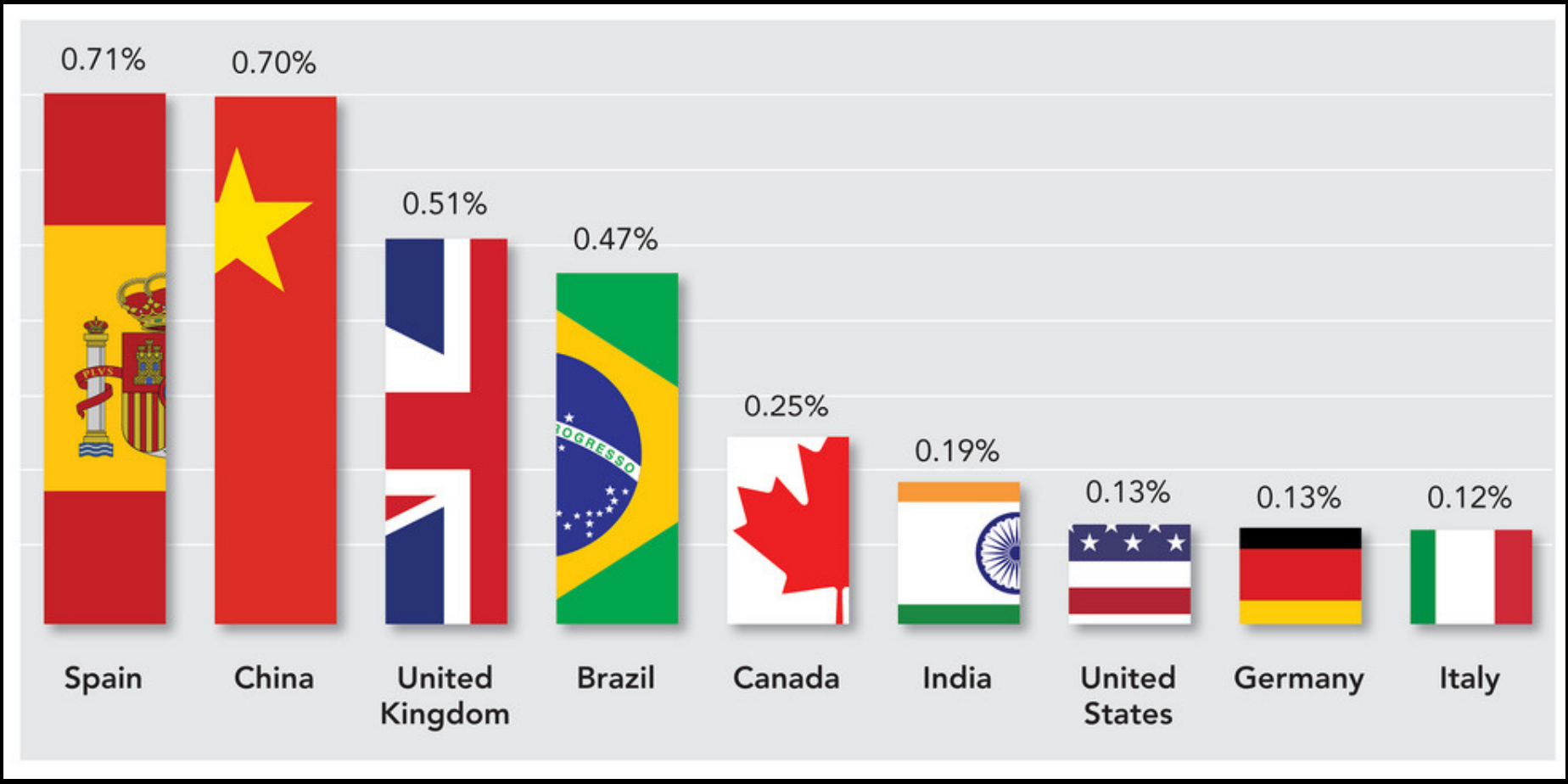
Agrivida

We are in a race to develop the clean energy technologies the world will demand.

China, EU countries and others recognize the economic opportunities and are investing *big*.

Top Countries in Clean Energy Investment

Clean Energy Investment as a Percentage of GDP



Source : Third Way Dec. “Creating a Clean Energy Century” (2010), and “Who’s Winning the Clean Energy Race? Growth, Competition and Opportunity in the World’s Largest Economies,” Report, The Pew Charitable Trusts.

Other evidence of the Chinese innovation challenge

• China has installed the highest voltage and capacity, lowest loss HVDC (800kV) and HVAC (1,000 kV) lines, and plans an integrated HVDC/HVAC backbone.

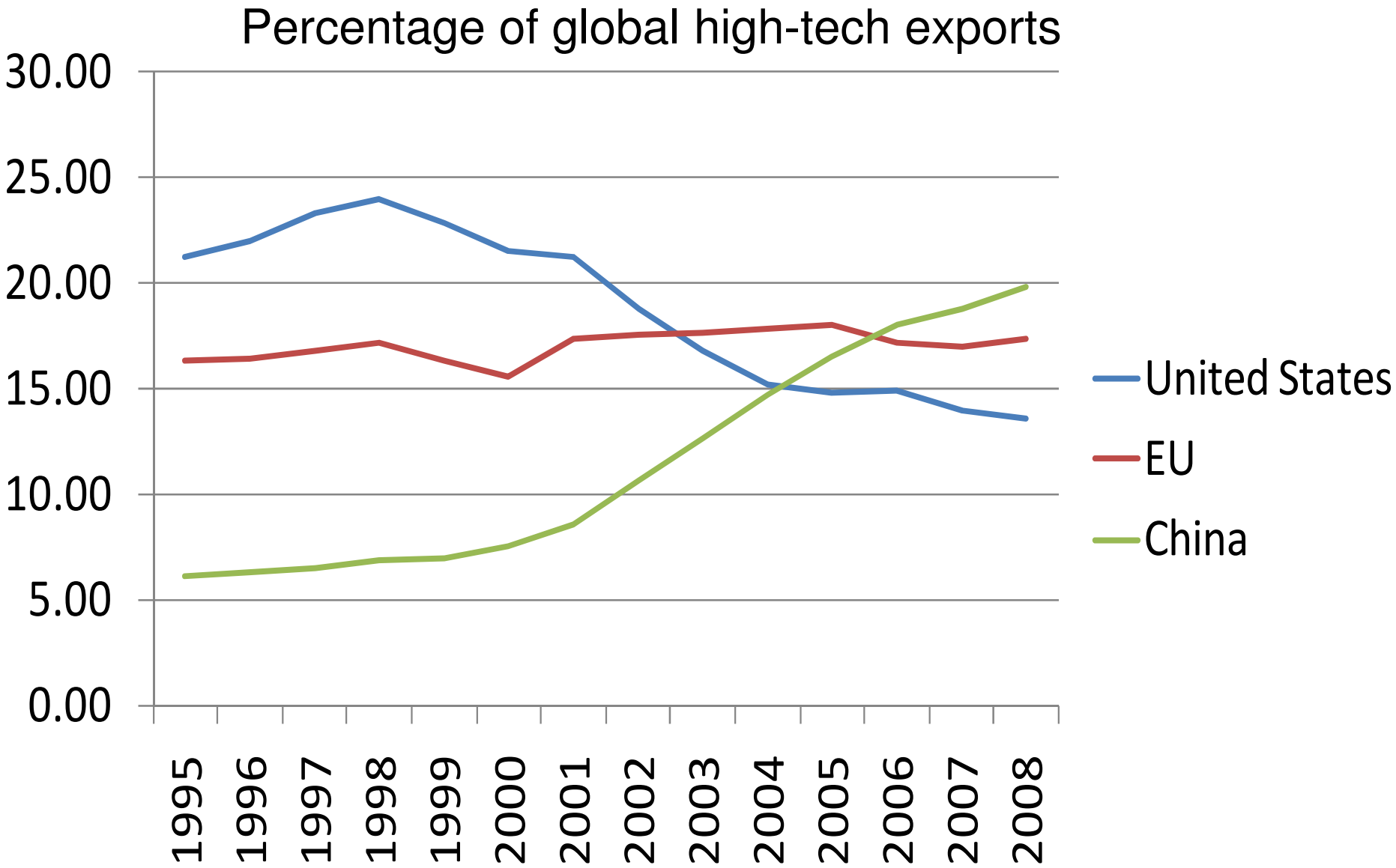
• Broken ground on ~ 25 nuclear reactors out of more than 60 world-wide.

• Just surpassed the U.S. with the fastest super-computer in the world.

• Holds the record for the highest speed rail in the world (with 220 mph operational speed). 5612 miles of new high-speed rail is now under construction. (Japan - 1524 miles; France - 1163, U.S. – 0)

• China will achieve 18% (and may reach 20%) renewable energy by 2020 according to Zhang Xiaoqiang, vice-chairman of China's National Development and Reform Commission.

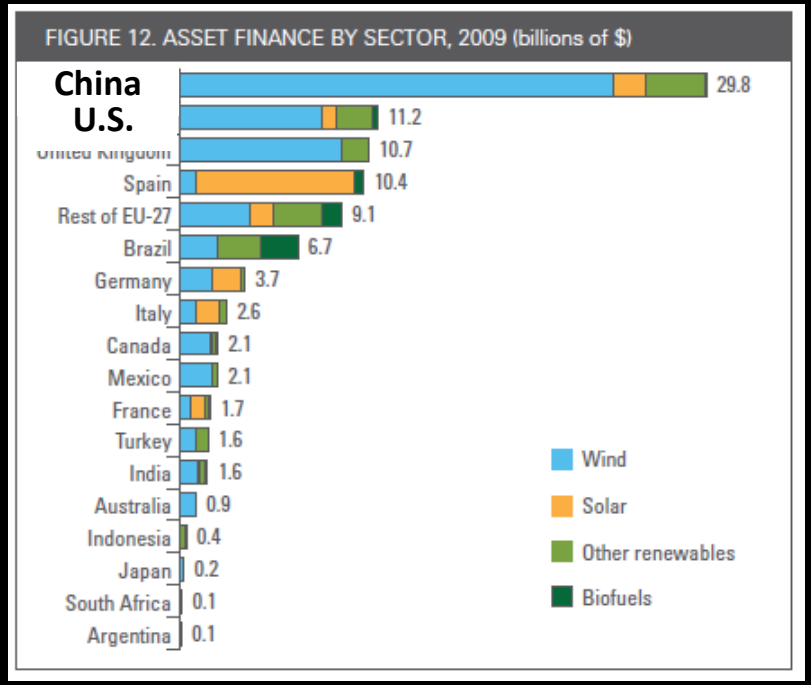
We are losing our *high-tech* manufacturing base



NSF Science and Engineering Indicators 2010

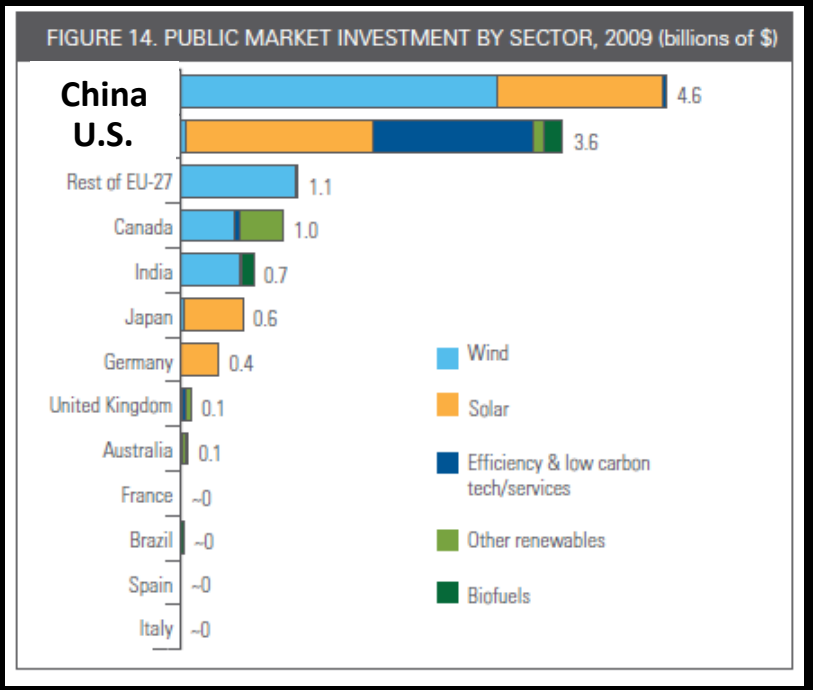
ASSET FINANCING:

Typically used to install clean energy equipment and generating capacity. It is an indicator of clean energy deployment and the creation of new jobs.



PUBLIC MARKET FINANCING:

Sale of stocks enables companies to raise capital for expansion and growth.

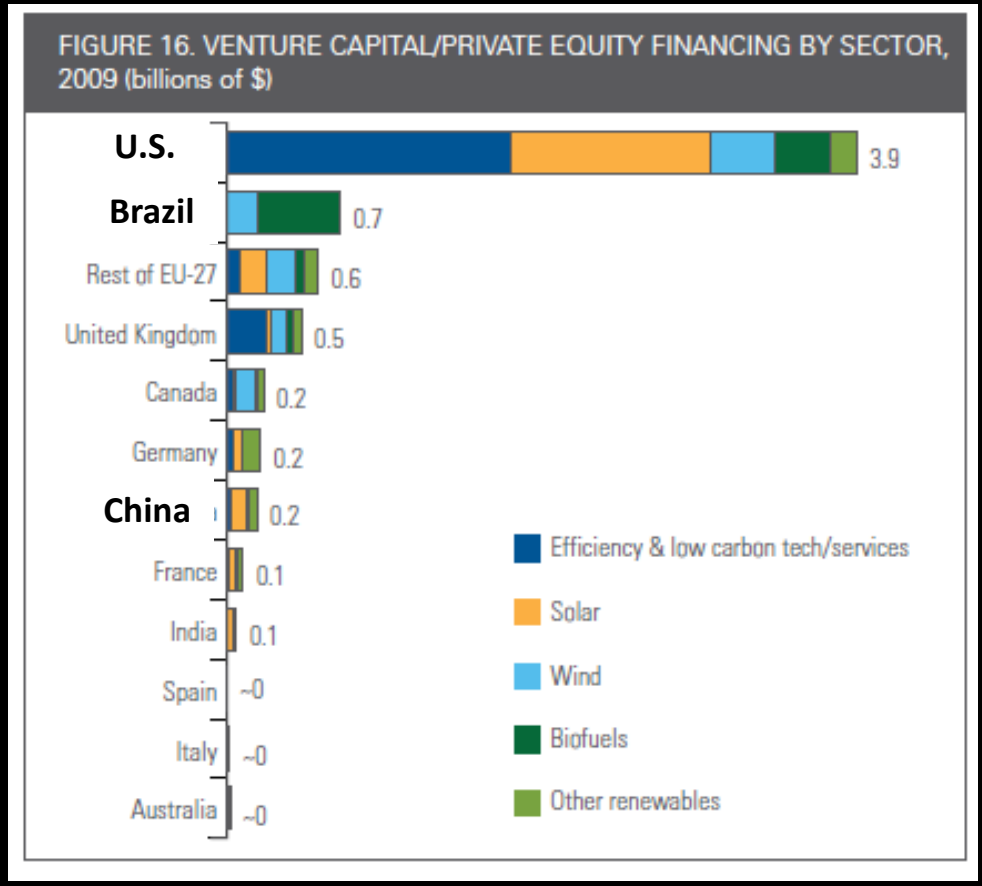


Profile of Venture Capital funding

There was a significant influx of venture capital in

Next-generation biofuels
Solar energy
Energy efficiency
Smart grid technologies

In response to the financial crisis, venture capitalists retreated from new companies and concentrated instead on well established entities.



We are in a race to develop the clean energy technologies the world will demand.

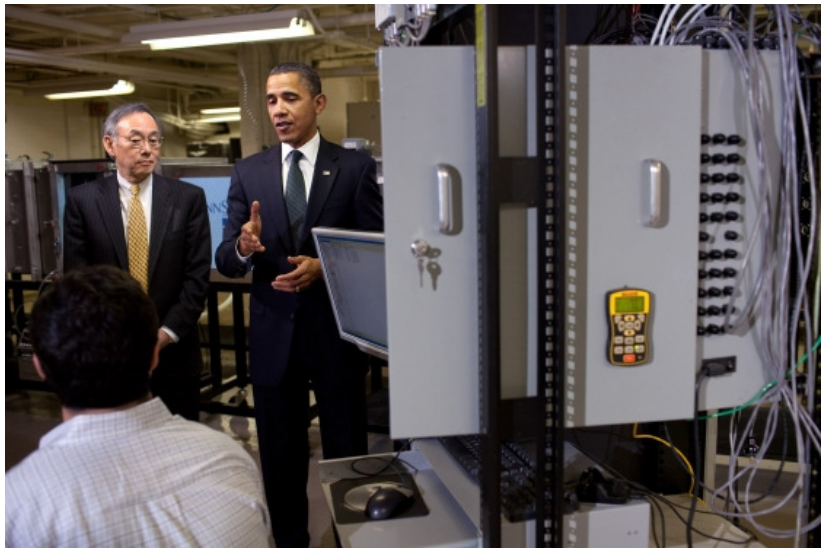
China, EU countries and others recognize the economic opportunities and are investing *big*.

What about the U.S.?

To create jobs, strengthen security and win the clean energy race, we need *long range policies* and a *sustained commitment* to supporting energy innovation.

President Obama is committed to making America the world's innovation leader.

Investing in Scientific R&D to Unleash Energy Innovation



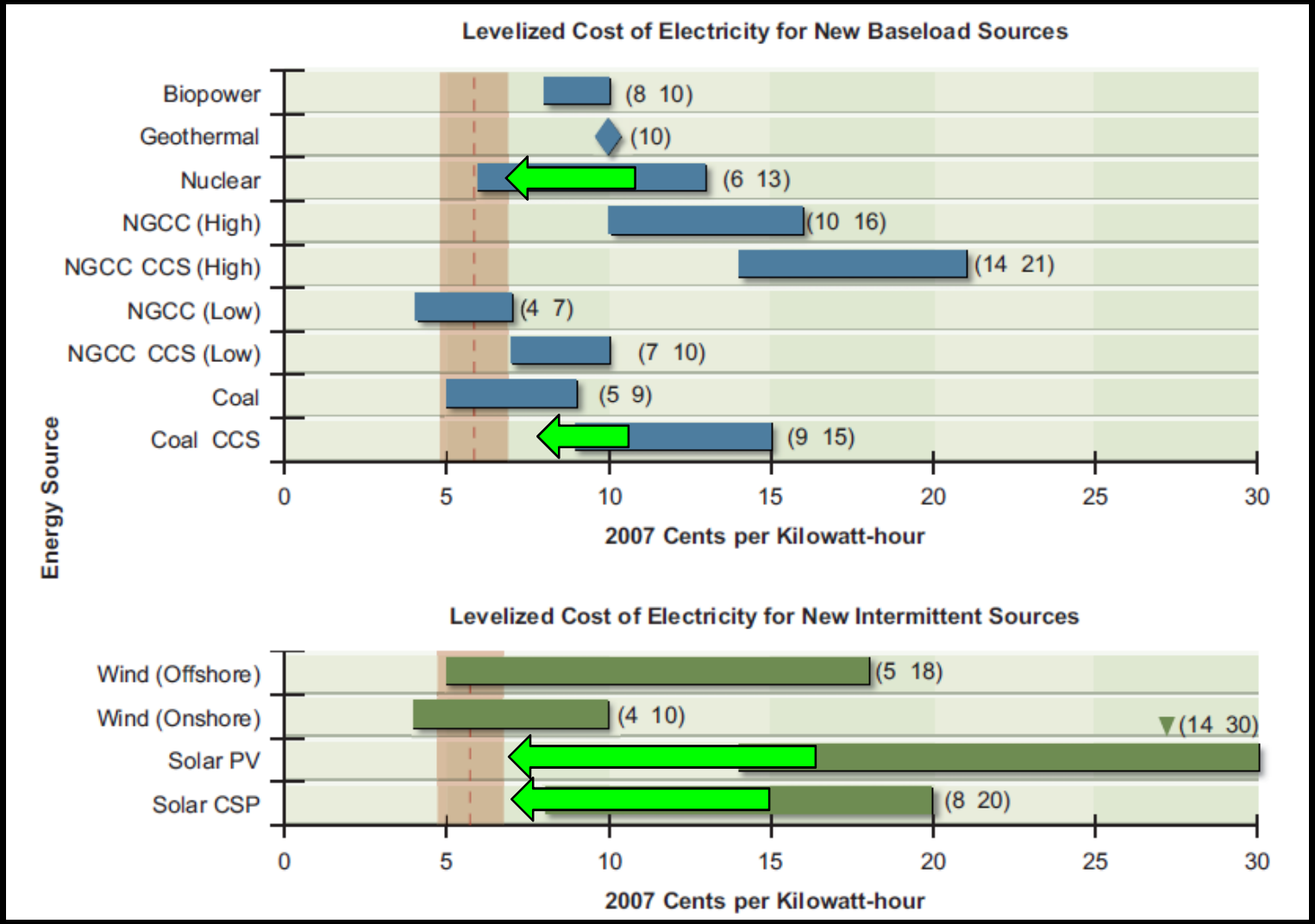
Touring Penn State University Engineering Labs to discuss energy innovation, 2/3/11

"Even as we cut out things that we can afford to do without, we have a responsibility to invest in those areas that will have the biggest impact in our future…"

-- President Obama, 2/14/11

To promote economic competitiveness, the President's budget makes critical investments in science and clean energy R&D.

The sun and wind are domestic sources of energy … but can the cost of clean energy (LOCE) be competitive with fossil energy?



Source: NAS/NAE *America's Energy Future*, 2010

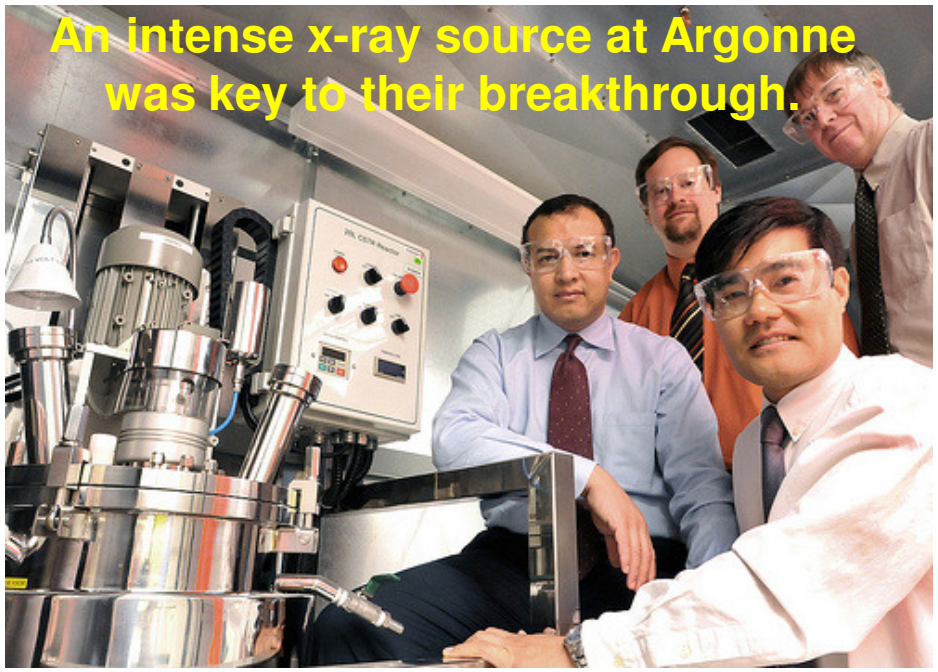
Federal support of R&D is critical to economic competitiveness (Example: Advanced Batteries)

DOE-supported research led to the development of the lithium-ion battery.

But technology leadership moved to Japan.

We've begun to reclaim technological leadership.

Argonne National Lab researchers have developed a unique suite of cathode materials to make lithium-ion batteries cheaper, safer and longer-lasting.



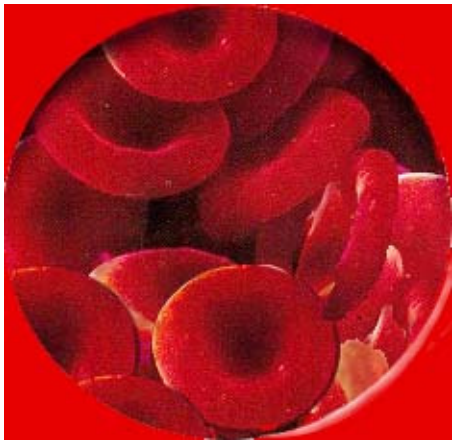
Leadership in High-Performance Computing Leads to New Technology and Savings for Semi Trucks

BMI Corporation performed aerodynamic simulations using a DOE supercomputer to reduce wind resistance on semi trucks.

By installing BMI's technology, the typical big rig can achieve **fuel savings between 7 and 12 percent.**

ARPA-E: Cutting-edge Research

Nature has found a way to capture, transport and release CO_2 without using excess energy.



A synthetic analogue of an enzyme used by red blood cells to capture CO_2 in the human body

A new approach to wind turbines based on proven jet engine designs

ARPA-E Program: Building Energy Efficiency Through Innovative Thermodevices (BEETIT)

Primary Energy Use for Cooling (kJ/kg)

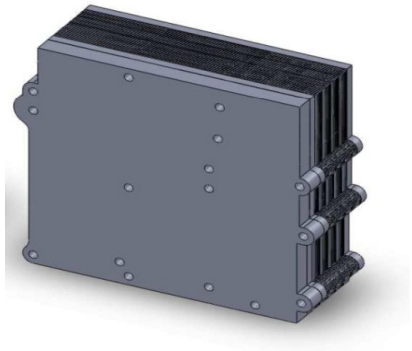
- 120 Today
- BEETIT Target & Competition
- 12 Theoretical Limit

Today

180 lb/ton-cooling

3X

Future



60 lb/ton-cooling

Georgia Tech, Georgia

President's Goal: Generating 80% of electricity from clean sources by 2035

"Clean energy breakthroughs will only translate into clean energy jobs if businesses know there will be a market for what they're selling." – President Obama

- Creates a ***guaranteed market*** for clean energy. The most competitive clean energy sources will win in the market place.
- Gives companies ***investment certainty***.
- Creates ***market certainty*** needed to create domestic manufacturing supply lines.
- Creates ***demand certainty*** known to simulate long-term grid investments.

America ***still*** has the opportunity to lead the world in clean energy and capture the jobs of the 21st century, but time is running out.

The train is leaving the station.

END